In the Claims

PLEASE AMEND THE CLAIMS AS FOLLOWS:

1. (CURRENTLY AMENDED) A method of fabricating a semiconductor color imager having an optical structure wherein an overcoat layer is adapted for optimizing long focal length microlens performance in an ordered process sequence comprising:

a semiconductor substrate having a matrix of imaging sensors formed thereon, each imaging sensor having a photosensitive area and a complementary non-photosensitive area, said matrix of imaging sensors being organized in a plurality of subsets;

forming a first matrix of light shields over the non-photosensitive areas of the matrix of imaging sensors;

forming a first passivation layer ~~over the matrix of imaging sensors~~;

forming a first optically transparent planarization layer over the first passivation layer ~~over the matrix of imaging sensors~~;

forming a first patterned color filter layer on the first optically transparent planarization layer, said first patterned color filter layer being registered with the photosensitive areas of a first subset of the matrix of imaging sensors;

forming upon th first patterned color filter layer a second ~~planarizing and/or patterned color filter layer~~ planarized layer, said second planarized layer comprising either a planarized spacer layer or a second color filter layer, said second color filter layer being in mutual registration with ~~the first color filter layer and a with~~ a second subset of photosensitive areas (color pixels);

forming upon the second ~~planarizing and/or color filter layer~~, planarized layer, a third ~~planarizing and/or color filter layer~~ planarized layer, said third planarized layer comprising either a planarized spacer layer or a third color filter layer, said third color filter layer being in mutual registration with ~~the first and second color filter layers and a~~ third subset of photosensitive areas (color pixels);

patterning a layer of microlens material to form a first matrix of microlenses over the third planarized layer, ~~planarizing and/or color filter layer,~~ said first matrix of microlenses being mutually registered with the photosensitive areas in the matrix of imaging sensors;

forming an overcoat layer over the first matrix of microlenses, said overcoat layer having high transmittance, said overcoat layer providing patterned or uniform optical compensation between the subsets of the matrix of the imaging sensors;

whereby said optical structure provides flexibility in design and optimized performance in a single color or a multiple color semiconductor imag r.

2. (ORIGINAL) The method of Claim 1, wh rein:

the semiconductor substrate material may be selected from the group consisting of periodic table IV, III-V, II-VI, or other simple or compound semiconductors.

3. (PREVIOUSLY PRESENTED) The method of Claim 1, wherein:

the matrix of imaging sensors comprise CMOS, CCD, or CID semiconductor sensors.

4. (CANCELLED)

5. (ORIGINAL) The method of Claim 1, wherein:

the overcoat layer is comprised of a negative type photoresist having refractive index adjusted to match the refractive index of the microlens material, nominally at n = 1.5.

6. (PREVIOUSLY PRESENTED) The method of Claim 1, wherein:

the overcoat layer is comprised of a patterned multilayer stack such that one or more color (interference) filters are thereby integrated with the overcoat material.

7. (CURRENTLY AMENDED) ~~The method of Claim 1, wherein:~~

~~a layer of microlens material is patterned to form a second matrix of microlenses over the first matrix of microlenses and beneath the overcoat layer, said second matrix of microlenses having a high transmittance undercoat, said second matrix of microlenses being registered with the first matrix of microlenses whereby a compound microlens structure and undercoat/overcoat layers are formed to~~

~~satisfy optical specification and performance.~~

A method of fabricating a semiconductor color imager having an optical structure wherein an overcoat layer is adapted for optimizing long focal length microlens performance in an ordered process sequence comprising:

a semiconductor substrate having a matrix of imaging sensors formed thereon, each imaging sensor having a photosensitive area and a complementary non-photosensitive area, said matrix of imaging sensors being organized in a plurality of subsets;

forming a first matrix of light shields over the non-photosensitive areas of the matrix of imaging sensors;

forming a first passivation layer;

forming a first optically transparent planarization layer over the first passivation layer;

forming a first patterned color filter layer on the first optically transparent planarization layer, said first patterned color filter layer being registered with the photosensitive areas of a first subset of the matrix of imaging sensors;

forming upon the first patt rned color filter layer a s cond planarized layer, said

second planarized layer comprising either a planarized spacer layer or a second color filter lay r, said s cond color filter layer being in mutual registration with a second subset of photosensitive areas (color pixels);

forming upon the second planarized layer a third planarized layer, said third planarized layer comprising either a planarized spacer layer or a third color filter layer, said third color filter layer being in mutual registration with a third subset of photosensitive areas (color pixels);

patterning a layer of microlens material to form a first matrix of microlenses over the third planarized layer, said first matrix of microlenses being mutually registered with the photosensitive areas in the matrix of imaging sensors;

forming an undercoat layer over the first matrix of micro lenses, said undercoat layer having high transmittance;

patterning a layer of microlens material to form a second matrix of microlenses over the undercoat layer, said second matrix of micro lenses being registered with the first matrix of micro lenses whereby a compound microlens structure is formed;

forming an overcoat layer over the second matrix of microlenses, said overcoat layer having high transmittance, said overcoat lay r providing patterned or

uniform optical compensation between the subsets of the matrix of the imaging s nsors;

whereby said compound optical structure provides flexibility in design and optimized performance in a single color or a multiple color semiconductor imager.

8. (PREVIOUSLY PRESENTED) The method of Claim 1, wherein:
the elements of the first matrix of microlenses may be selected from the group consisting of simple hemispherical convex, plano-convex, hemicylindrical, aspheric, holographic, Fresnel, conic sections, or combinations of known lens classes.

9. (PREVIOUSLY PRESENTED) The method of Claim 1, wherein:
the microlens layer material is selected from the group of positive or negative conventional photolithographic materials.

10. (CURRENTLY AMENDED) ~~The method of Claim 1,~~ A method of fabricating a semiconductor color imager having an optical structure wherein an overcoat layer is adapted for optimizing long focal length microlens performance in an ordered process sequence comprising:

a semiconductor substrate having a matrix of imaging sensors formed thereon, each imaging sensor having a photosensitive area and a complementary non-

photosensitive area, said matrix of imaging sensors b ing organized in a plurality of subsets;

forming a first matrix of light shields over the non-photosensitive areas of the matrix of imaging sensors;

forming a first passivation layer;

forming a first optically transparent planarization layer over the first passivation layer;

forming a first patterned color filter layer on the first optically transparent planarization layer, said first patterned color filter layer being registered with the photosensitive areas of a first subset of the matrix of imaging sensors;

forming upon the first patterned color filter layer a second planarized layer, said second planarized layer comprising either a planarized spacer layer or a second color filter layer, said second color filter layer being in mutual registration with a second subset of photosensitive areas (color pixels);

forming upon the second planarized layer a third planarized layer, said third planarized layer comprising either a planarized spacer layer or a third color filter layer, said third color filter layer being in mutual registrati n with a third subset of

photosensitive areas (color pixels);

patterning a layer of microlens material to form a first matrix of microlenses over the third planarized layer, said first matrix of microlenses being mutually registered with the photosensitive areas in the matrix of imaging sensors;

forming an overcoat layer over the first matrix of microlenses, said overcoat layer having high transmittance, said overcoat layer providing patterned or uniform optical compensation between the subsets of the matrix of the imaging sensors;

wherein said overcoat layer is exposed to calibrated dosages of ultraviolet or other irradiation to photopolymerize the high transmittance overcoat material whereby the index of refraction, polarizing properties, spectral absorption characteristics are tailored and the overcoat material molecules are cross-linked to provide thickness control .

11. (ORIGINAL) The method of Claim 9, wherein:
the overcoat layer is comprised of a negative type photoresist to serve as a thermal barrier and protective encapsulant for a microlens layer material comprising a positive type photoresist.

12. (CURRENTLY AMENDED) ~~The method of Claim 1~~ A method of fabricating a semiconductor color imager having an optical structure wherein an overcoat layer is adapted for optimizing long focal l ngth microlens performance

in an ordered process sequ nce comprising:

a semiconductor substrate having a matrix of imaging sensors formed thereon, each imaging sensor having a photosensitive area and a complementary non-photosensitive area, said matrix of imaging sensors being organized in a plurality of subsets;

forming a first matrix of light shields over the non-photosensitive areas of the matrix of imaging sensors;

forming a first passivation layer;

forming a first optically transparent planarization layer over the first passivation layer;

forming a first patterned color filter layer on the first optically transparent planarization layer, said first patterned color filter layer being registered with the photosensitive areas of a first subset of the matrix of imaging sensors;

forming upon the first patterned color filter layer a second planarized layer, said second planarized layer comprising either a planarized spacer layer or a second color filter layer, said second color filter layer being in mutual registration with a second subset of photosensitive areas (color pixels);

forming upon th second planarized layer a third planarized layer, said third planarized layer comprising either a planarized spacer layer or a third color filter layer, said third color filter layer being in mutual registration with a third subset of photosensitive areas (color pixels);

patterning a layer of microlens material to form a first matrix of microlenses over the third planarized layer, said first matrix of microlenses being mutually registered with the photosensitive areas in the matrix of imaging sensors;

forming an overcoat layer over the first matrix of microlenses, said overcoat layer having high transmittance, said overcoat layer providing patterned optical compensation between the subsets of the matrix of the imaging sensors;

wherein the overcoat is exposed to a masked pattern of ultraviolet or other irradiation to form a matrix areas within the overcoat with adjusted properties, said masked pattern being registered with one or more subsets of the matrix of the imaging sensors, whereby imaging sensor subset gain-balance and attenuation is provided.

13. (PREVIOUSLY PRESENTED) The method of Claim 1, wherein: the microlens focal length and depth of focus is adjusted by controlling the thickness and refractive index in the final fabrication st p of the color imager.

14. (PREVIOUSLY PRESENTED) Th method of Claim 1, wh rein:

the first matrix of microlenses is exposed to ultraviolet or other irradiation, including thermal processes, to further polymerize the microlens layer material to increase the refractive index at a fixed radius of curvature, to tune the focal length of the microlens-overcoat optical structure.

15. (ORIGINAL) The method of Claim 1, wherein:

the overcoat is comprised of a material satisfying at least

the following three requirements:

(1) of index of refraction matched to that of the index of refraction of the microlenses, e.g., n = 1.5,

(2) thermal resistance >270 degrees Centigrade, 85

(3) transmittance >95%.

16. (WITHDRAWN)

17. (WITHDRAWN)

18. (PREVIOUSLY PRESENTED) The method of Claim 1 wherein:

a second matrix of light shields together with a second passivation layer is formed upon the ~~first~~ first passivation layer and below the first optically transparent planarization lay r, said second matrix of light shields being

registered with the first matrix of light shi lds.

19. (PREVIOUSLY PRESENTED) The method of Claim 18 wherein: a third matrix of light shields together with a third passivation layer is formed on the second matrix of light shields and below the first ~~first~~ optically transparent planarization layer, said third matrix of light shields being registered with the second matrix of light shields.

20 (CANCELED)

21. (CANCELED)

22. (PREVIOUSLY PRESENTED) The method of Claim 1, wherein: the first matrix of microlenses is exposed to an ultraviolet or other irradiation pattern to further polymerize a subset of the first microlens matrix to increase the refractive index at a fixed radius of curvature, to optically tune a subset of the optical structure.

23. (PREVIOUSLY PRESENTED) The method of Claim 7, wherein: the elements of the first and second matrix of microlenses may be selected from the group consisting of compound hemispherical convex, plano-convex, hemicylindrical, aspheric, holographic, Fresnel, conic sections, or combinations of known lens classes.